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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/657,193

09/09/2003

Daisuke Ito

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09/09/2004

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EXAMINER

DANG, TRUNG Q

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 09/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s) UK	
	10/657,193	ITO, DAISUKE	
	Examiner	Art Unit	
	Trung Dang	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>09/09/03</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 4, and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahmad et al. (U.S. Pat. 5,209,817).

With reference to the second embodiment illustrated in Figs. 18-21, Ahmad et al. teach a method of forming a conductor wiring pattern comprising the steps of:

forming a first photosensitive polyimide layer (10) (corresponding to the claimed first insulating layer) on a surface of a substrate (12);

forming a second photosensitive polyimide layer (40) (corresponding to the claimed second photosensitive insulating resin layer) thereon;

exposing and developing the second photosensitive insulating resin layer to form pattern grooves so that the first photosensitive polyimide layer is exposed at bottoms of the pattern grooves;

forming a plating seed layer (42) on the second photosensitive insulating resin layer including inner surfaces of the pattern grooves; and
electroless plating copper (46) to fill the grooves.

The second embodiment of Ahmad et al. differs from the claims in that while the second embodiment employs electroless plating for depositing copper wiring (46), the claims call for an electrolytic plating to deposit the same.

However, in the first embodiment depicted in Figs. 5-7, Ahmad et al. teach an electroplating process for filling pattern grooves with copper. The process comprises:

forming a resist pattern (18) on the plating seed (19) except for pattern grooves 17' and 21 (Fig. 5 and col. 2, lines 54-60); filling the pattern grooves with copper by an electroplating (same as electrolytic plating) using the plating seed (19) as an electrode; and removing the resist pattern (18) and then removing exposed portions of the plating seed layer (19) to form wiring pattern consisting of copper remained in the pattern grooves (Figs. 6-7 and col. 3, lines 1-4, and 64-68).

The subject matter as a whole would have been obvious to one of ordinary skill in the art to employ electroplating process as described above for depositing copper in the pattern grooves 17 and 21 of Fig. 18 because of the benefits disclosed in col.3, lines 4-15 and lines 26-42. That is, electroplating process not only produces planar surface of the wiring pattern but also the size of the wiring pattern is determined by the size of the pattern grooves, hence the formation accuracy of the wiring pattern is improved, particularly in high-density packaging.

For claim 4, see col. 2, lines 47-49 for the curing of the first photosensitive polyimide layer (10) (corresponding to the claimed limitation "the first insulating layer is heated and hardened"). Also, see Fig. 1 wherein pad (16) reads on the claimed limitation "first wiring pattern formed on the substrate".

For claim 5, see col. 2, lines 39-40 for the disclosure of the substrate 12 is a semiconductor substrate and has an electrode terminal forming surface (pad 16).

3. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahmad et al. as above taken with Masahiro et al. (reference AH cited by applicant in the submitted PTO-1449).

Ahmad et al. teach a method of forming a conductor wiring pattern as noted above. Ahmad et al. differ from the claims in not disclosing that the conductor

filling the pattern grooves is a plurality of different metal layers. Masahiro et al. teach the benefit of coating a cap layer 18 consisting of nickel/gold or nickel/palladium or nickel/gold/palladium on wiring layer 16 deposited by electrolytic plating (see abstract and Fig. 2). It would have been obvious to one of ordinary skill in the art to coat the surface of the copper wiring of Ahmad with the cap layer 18 as suggested by Masahiro for the benefit of protecting the copper wiring from being corroded.

4. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (Pub. No.: US 2004/0166659 (the effective filing date pertaining to the electroplating feature is May 24, 2002)) in view of Ahmad et al. as above.

With reference to Figs. 12b-12g, Lin et al. teach a method of forming a conductor wiring pattern comprising the steps of:

- forming a first insulating layer (4) on a surface of a substrate (1);
- forming a second polymer layer (5) (corresponding to the claimed second photosensitive insulating resin layer) thereon;
- forming pattern grooves (7) so that the first insulating layer (4) is exposed at bottoms of the pattern grooves (Fig. 12b);
- forming a plating seed layer (200/202) on the second polymer layer (5) including inner surfaces of the pattern grooves (Fig. 12c);
- forming a resist pattern (203) on the plating seed except for the pattern grooves (7) (Fig. 12d);
- filling the pattern grooves with copper by an electroplating (same as electrolytic plating) using the plating seed as an electrode (Fig. 12e and paragraph [0053]); and
- removing the resist pattern (203) and also removing the plating seed layer exposed on the surface of the second polymer layer to form wiring pattern consisting of copper remained in the pattern grooves (Figs 12f-12g).

Lin et al. differ from the claim in the materials used for the first insulating layer (4) and the second polymer layer (5).

Ahmad et al. teach photosensitive polyimide is used as an insulating base on which copper is electroplated to fill openings formed in the insulating base (Figs. 18, 21 and col. 5, lines 64-68).

It would have been obvious to one of ordinary skill in the art to use photosensitive polyimide as material for the first insulating layer (4) and the second polymer layer (5) of Lin because the use of the photosensitive polyimide material eliminates necessary steps of forming photoresist masks to etch opening 7, 7' in layers 4 and 5 of Fig. 12b, hence saving processing step and therefore reducing manufacturing cost.

For claims 2 and 3, see paragraph [0054] in Lin et al. in which a nickel cap layer is used to prevent copper corrosion.

For claim 4, see col. 2, lines 47-49 in Ahmad et al. for the curing of the first photosensitive polyimide layer (10) (corresponding to the claimed limitation "the first insulating layer is heated and hardened"). Also, see Fig. 12b in Lin et al., wherein metal wiring (6) and metal pad (2) reads on the claimed limitations "first wiring pattern formed on the substrate" of claim 4 and "electrode terminal" of claim 5, respectively.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trung Dang
Primary Examiner
Art Unit 2823

A handwritten signature in cursive script, appearing to read 'Trung Dang', is positioned below the printed name and title.

09/02/04